

CLAIMS

What is claimed is:

1. A transgenic plant which is tolerant to a salt, comprising one or more plant cells transformed with exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant.
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2. The transgenic plant of Claim 1 wherein the exogenous nucleic acid encodes AVP1 or a homologue thereof.
3. The transgenic plant of Claim 2 wherein the homologue of AVP1 is obtained from tobacco, bacteria, tomato or corn.
- 10 4. The transgenic plant of Claim 2 wherein the AVP1 is present in a construct designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.
5. The transgenic plant of Claim 4 wherein the construct comprises AVP1 operably linked to a double tandem enhancer of a 35S promoter.
- 15 6. The transgenic plant of Claim 2 wherein the AVP1 is derived from a wild type plant that corresponds to a wild type of the transgenic plant.
7. The transgenic plant of Claim 2 wherein the AVP1 is derived from a wild type plant that does not correspond to a wild type of the transgenic plant .
- 20 8. A transgenic plant which grows in a concentration of a salt that inhibits growth of a corresponding non-transgenic plant.

9. The transgenic plant of Claim 8 wherein the concentration of salt is about 0.2M to about 0.3M.
 10. The transgenic plant of Claim 1 wherein the plant is larger than a corresponding non-transgenic plant.
- 5 11. A transgenic progeny of the transgenic plant of Claim 1.
12. Seeds produced by the transgenic plant of Claim 1.
13. A progeny transgenic plant grown from seed of Claim 12.
14. A transgenic plant which is tolerant to a salt comprising an exogenous nucleic acid construct which is designed to overexpresses AVP1 or designed to down regulate endogenous pyrophosphatase.
- 10 15. A transgenic progeny of the transgenic plant of Claim 14.
16. Seeds produced by the transgenic plant of Claim 14.
17. A progeny transgenic plant grown from seed of Claim 16.
18. The transgenic plant of Claim 14 wherein the construct comprises an AVP1 gene operably linked to a double tandem enhancer of a 35S promoter.
- 15 19. A construct comprising an AVP1 gene operably linked to a chimeric promoter designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.

20. The construct of Claim 19 wherein the AVP1 gene is operably linked to a double tandem enhancer of a 35S promoter.
 21. A transgenic plant obtained by introducing into a plant exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant.
- 5 22. Plant cells comprising exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant cell.
23. The plant cells of Claim 22 wherein the plant cells are root cells or stem cells.
 24. The plant cells of Claim 22 wherein the exogenous nucleic acid encodes AVP1.
 25. The plant cells of Claim 24 wherein the AVP1 is present in a construct designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.
- 10 26. The plant cells of Claim 25 wherein the construct comprises the AVP1 gene operably linked to a chimeric promoter designed to overexpress AVP1.
27. The plant cells of Claim 26 wherein the AVP1 gene is operably linked to a double tandem enhancer of a 35S promoter.
 - 15 28. The plant cells of Claim 24 wherein the AVP1 is derived from a wild type plant that corresponds to a wild type of the transgenic plant.
 29. The plant cells of Claim 24 wherein the AVP1 is derived from a wild type plant that does not correspond to a wild type of the transgenic plant.

30. A method of making a transgenic plant which is tolerant to a salt comprising introducing into one or more cells of a plant exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant to yield transformed cells in the plant, thereby producing a transgenic plant which is tolerant to the salt.
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31. The method of Claim 30 further comprising regenerating plants from the transformed cells to yield transgenic plants and selecting a transgenic plant which is tolerant to the salt, thereby producing a transgenic plant which is tolerant to the salt.
- 10 32. The method of Claim 30 wherein the exogenous nucleic acid encodes AVP1.
33. The method of Claim 32 wherein the AVP1 is present in a construct designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.
34. The method of Claim 33 wherein the construct comprises the AVP1 gene operably linked to a chimeric promoter designed to overexpress AVP1.
- 15 35. The method of Claim 34 wherein the AVP1 gene is operably linked to a double tandem enhancer of a 35S promoter.
36. The method of Claim 32 wherein the AVP1 is derived from a wild type plant that corresponds to a wild type of the transgenic plant.
- 20 37. The method of Claim 32 wherein the AVP1 is derived from a wild type plant that does not correspond to a wild type of the transgenic plant.
38. The method of Claim 30 wherein the plant is tolerant to a concentration of salt that inhibits growth of a corresponding non-transgenic plant.

39. The transgenic plant of Claim 38 wherein the concentration of salt is about 0.2M to about 0.3M.

40. A transgenic plant produced by the method of Claim 30.

41. A method of making a transgenic plant which is tolerant to a salt comprising introducing into one or more cells of a plant a nucleic acid construct which is designed to overexpress AVP1 to yield transformed cells thereby producing a transgenic plant which is tolerant to the salt.

42. The method of Claim 41 further comprising regenerating plants from the transformed cells to yield transgenic plants and selecting a transgenic plant which is tolerant to the salt, thereby producing a transgenic plant which is tolerant to the salt.

43. A transgenic plant produced by the method of Claim 41.

44. A method of making a transgenic plant which is larger than its corresponding wild type plant comprising introducing into one or more cells of a plant nucleic acid which alters expression of vacuolar pyrophosphatase in the plant to yield transformed cells, thereby producing a transgenic plant which is larger than its corresponding wild type plant.

45. The method of Claim 44 further comprising regenerating plants from the transformed cells to yield transgenic plants and selecting a transgenic plant which is larger than its corresponding wild type plant, thereby producing a transgenic plant which is larger than its corresponding wild type plant.

46. The method of Claim 44 wherein the exogenous nucleic acid encodes AVP1.

47. The method of Claim 46 wherein the AVP1 is present in a construct designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.
 48. The method of Claim 47 wherein the construct comprises the AVP1 gene operably linked to a chimeric promoter designed to overexpress AVP1.
- 5 49. The method of Claim 48 wherein the AVP1 gene is operably linked to a double tandem enhancer of a 35S promoter.
50. The method of Claim 46 wherein the AVP1 is derived from a wild type plant that corresponds to a wild type of the transgenic plant.
 - 10 51. The method of Claim 46 wherein the AVP1 is derived from a wild type plant that does not correspond to a wild type of the transgenic plant.
 52. The method of Claim 44 wherein the transgenic plant is grown in soil.
 53. The method of Claim 44 wherein the transgenic plant is grown hydroponically.
 54. A transgenic plant produced by the method of Claim 44.
- 15 55. A method of bioremediating soil comprising growing one or more transgenic plants and/or progeny thereof in the soil, wherein the transgenic plants and/or progeny thereof comprise exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant.
56. A method of increasing the yield of a plant comprising introducing into one or more cells of a plant nucleic acid which alters expression of vacuolar

pyrophosphatase in the plant to yield transformed cells, thereby increasing the yield of the plant.

57. The method of Claim 56 further comprising regenerating plants from the transformed cells to yield transgenic plants and selecting a transgenic plant which is larger than its corresponding wild type plant, thereby increasing the yield of the plant.
58. A method of removing cations from a medium which can support plant growth comprising growing one or more transgenic plants and/or progeny thereof in the medium, wherein the transgenic plants and/or progeny thereof comprise exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant.
- 10 59. The method of Claim 58 wherein the medium is selected from the group consisting of: soil and water.
- 15 60. The method of Claim 58 wherein the cations are selected from the group consisting of: sodium, calcium, manganese and lead.
61. A method of producing a transgenic plant which grows in salt water comprising introducing into one or more cells of a plant exogenous nucleic acid which alters expression of vacuolar pyrophosphatase in the plant to yield transformed cells, thereby producing a transgenic plant which can grow in salt water.
- 20 62. The method of Claim 61 further comprising regenerating plants from the transformed cells to yield transgenic plants and selecting a transgenic plant which grow in salt water, thereby producing a transgenic plant which can grow in salt water.

63. The method of Claim 61 wherein the concentration of the salt water is from about 0.2M to about 0.3M.
64. The method of Claim 63 wherein the salt water is seawater.
65. A transgenic plant which is tolerant to a salt, comprising one or more plant cells transformed with exogenous nucleic acid which alters expression of a vacuolar pyrophosphatase and an Na^+/H^+ antiporter in the plant.
 66. The transgenic plant of Claim 65 wherein the vacuolar pyrophosphatase is AVP1 or a homologue thereof.
 67. The transgenic plant of Claim 66 wherein the homologue of AVP1 is from tobacco, bacteria, tomato or corn.
 68. The transgenic plant of Claim 66 wherein the AVP1 is present in a construct designed to overexpress AVP1 or designed to down regulate endogenous pyrophosphatase.
 69. The transgenic plant of Claim 68 wherein the construct comprises AVP1 operably linked to a double tandem enhancer of a 35S promoter.
 70. The transgenic plant of Claim 65 wherein the Na^+/H^+ antiporter is AtNHX1 or a homologue thereof.
 71. A transgenic progeny of the transgenic plant of Claim 65.
 72. Seeds produced by the transgenic plant of Claim 65.

73. A progeny transgenic plant grown from the seed of Claim 72.
74. A method of making a transgenic plant having increased flower size compared to its corresponding wild type plant comprising introducing into one or more cells of a plant nucleic acid which alters expression of vacuolar pyrophosphatase in the plant to yield transformed cells, thereby producing a transgenic plant having increased flower size compared to its corresponding wild type plant.
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75. The method of Claim 74 wherein the exogenous nucleic acid encodes AVP1.
76. A transgenic plant produced by the method of Claim 74.